REVIEW ARTICLES

The Biological and Psychological Impacts of Drug Addiction: A Review.

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Definition

Addiction may be defined as the abnormal function of brain reward and memory centers and their related neural circuits. It is considered as a primary chronic disease of the brain. Abnormality of these brain circuits can result in clinical manifestations that are clearly seen in an individual who chronically pursue reward and/or relief by taking substances [1]. Patients will have an intense desire to seek and use substance, such as alcohol or drugs and continues using them despite he knows that they will cause problems to his health and behavior[1,2].

Addiction is characterized by:

a. inability to get rid of taking these addictive drugs
b. inability to control his behavior,
c. there is intense and irresistible Craving,
d. the addict losses his ability to recognize significant problems in his behaviors and his relationships with others, and
e. A disturbed emotional responses.

As chronic diseases, addiction often shows alternative courses of exacerbations and remission. Unless treated with medicines or rehabilitation activities, addiction may progressively worse and can result in premature death or chronic disability [3].

Risk Factors and Pathophysiology

Although there are many factors that predispose to addition, there is only one biological process that forms the core pathology which leads to the development and maintenance of addiction, which is the repeated exposure to an addictive substance [4]. The commonest predisposing factors are:

Genetic and environmental factors

There is a good body of evidences which suggests that genetic factors together with environmental factors, such as chronic exposure to addictive drugs and easy availability of them, are significant contributors to addiction vulnerability [5]. It has been estimated that genetic factors account for 40–60% of the risk factors for alcoholism [6].It has also been postulated that environmental risk factors such as chronic exposure to addictive drugs during lifetime, interacts with the individual's genetic composition to increase or decrease their vulnerability to addiction [4]. The National Institute on Drug Abuse (NIDA) puts the lack or absence of parental supervision on children and adolescents as well as drug availability and poverty as main risk factors for drug abuse [6].

Age

It is well known that the reward control centers in the brain of adolescent mature before the cognitive behavioral centers. This leads to dominance of the incentive rewards systems on the decision-making process. For this reason, adolescents are more likely to act according to their impulses and engage in risky behaviors without considering the possible dangerous outcomes [7]. Moreover, adolescents are not only more likely to initiate and maintain drug abuse, but, once addicted, they are more resistant to treatment and more susceptible to relapse [8,9].

Epigenetic factors

It has long been recognized that epigenetic genes and their products are the main components through which environmental factors can affect the genes of an individual [5]; these genes also act as the mean by which epigenetic trait are transmitted through generation. Epigenetic transmission is a phenomenon in which

environmental influences on the genes of a parent can affect the traits and behavioral phenotypes of their offspring [5]. It has been reported that some of the alterations to the epigenome which arise through chronic exposure to drugs can be transmitted across generations, which in turn affect the behavior of the children [5, 10]. The epigenetic alterations that have been implicated in epigenetic inheritance include DNA methylation, histone modifications, and down regulation or upregulation of micro RNAs [5]. Based upon evidence from animal research, it has been found that addiction-induced epigenetic alterations in rats can be transmitted from parent to offspring and produce behavioral phenotypes that decrease the offspring's risk of developing an addiction [5].

Neurologic pathways of Addiction

The brain is a communications center, consisting of billions of neuron which form numerous networks. These networks pass messages back and forth among different centers within the (CNS) and (PNS). These are formed by:

a. The projections from the ventral tegmental area (VTA) form a dopaminergic neurons network with localized postsynaptic glutamate receptors. These cells respond when reward stimuli are present. The VTA supports learning and sensory development and releases dopamine into the forebrain [11].

b. These neurons also project and release dopamine into the nucleus Accumbens [12] through the mesolimbic pathway. Virtually all drugs that cause addiction increase the dopamine release in the mesolimbic pathway [13], in addition to their specific effects.

c. The nucleus Accumbens (NAcc) is an output of the VTA projections. It consists mainly of GABAergic medium spiny neurons (MSNs) [14]. The NAcc is associated with conditioned behaviors, and it has been found to be involved in the increased sensitivity to drugs as addiction progresses [11].

d. The prefrontal cortex, including the anterior cingulate and orbito-frontal cortices[15] is another VTA output in the meso-corticolimbic pathway; it is important for the integration of information which helps determine whether a behavior will be elicited [16]. It is also critical for forming associations between the rewarding experiences of drug use and hints from the environment. These hints from the surrounding are strong mediators of drug-seeking behavior, and can trigger relapse even after months or years of abstinence [17].

Pathophysiology of addiction

Dopamine plays a key role in the pathogenesis of addiction. It is a neurotransmitter present in neurons in regions of the brain that regulate movement, emotion, motivation, and feelings of pleasure. Some drugs, such as marijuana and heroin, can activate these neurons, by the virtue of their similarity in structure to natural neurotransmitter, thus, allowing them to attach onto and activate these neurons [17]. Although these drugs mimic the brain's own chemicals, they don't activate neurons in the same way as a natural neurotransmitters, leading to abnormal messages being transmitted through the neural network. Other drugs, such as amphetamines or cocaine, can cause the neurons to release abnormally large amounts of natural neurotransmitters or prevent the normal reuptake of these chemicals at neuronal synapses [14]. This disruption in cycle produces a greatly amplified message that ultimately disrupts communication channels [18].

Dopamine system rewards our natural behaviors when activated at normal levels. However, overstimulation of the dopamine system with drugs produces euphoric effects, which strongly reinforce the behavior of drug use—teaching the user to repeat it. Human brains are programmed to ensure that we will repeat life-sustaining activities by associating those activities with pleasure or reward [19]. Whenever this reward circuit is activated, the brain notes that something important is happening that needs to be remembered, and teaches us to do it again in the same circuit, we learn to abuse drugs in the same way again without thinking about it. When some drugs of abuse are taken, they can release 2 to 10 times the amount of dopamine that natural rewards, such as eating and sex do. In some cases, this occurs almost immediately (as when drugs are smoked or injected), and the effects can last much longer than those produced by natural rewards. The resulting effect is that the circuits of pleasure of the brain produced by naturally rewarding stimuli become unresponsive [20]. Thus, dopamine's impact on the reward circuit of the brain of someone who abuses drugs can become abnormally low and, that person's ability to experience any pleasure is reduced [21].

Sign and symptom

Drugs that are psychoactive, such as cannabis, alcohol, ecstasy and heroin, can affect our mood. They can stimulate certain emotions or inhibit others. This may be why addicts use them [22]. The changes

in our mood or behavior caused by drugs are the result of changes to our brains. Drugs interfere with the chemicals in our brains and consequently, the messages that those chemicals are trying to send [22].All psychoactive drugs can cause mental health problems, both while addicts are taking them and as they stop taking them (withdrawal). These problems can include anxiety, mood swings, depression, sleep problems and psychosis. Patients may have panic attacks in form of periods of very severe anxiety, when heart rate increases, with trembling, sweats, shortness of breath, and a fear of losing control [23].

Addicts may feel like their surroundings are strange and unreal, or they are losing their personal identity and sense of reality. Psychoactive drugs can cause delusions, in form of believing that things aren't true, or hallucinations – seeing or hearing things that are not there. They may have times when they feel depressed – sad, restless, irritable, tired, loss of pleasure, or manic – elevated mood, delusions, impulsive behavior, racing thoughts. This is called mood disorder and may be caused by drugs such as cocaine, amphetamines, heroin and methadone [24]. Psychoactive drugs may also cause ongoing mental health problems. It is not clear why this happens to some people and not others. It may be that using a drug has triggered a mental illness they didn't know that they had, or the drug changes the way a certain chemical affects their brain functions. When try to deal with addiction and a mental health disorder, it is hard to know where one ends and the other begins [25, 26**].**

Psychological problems that are associated with addiction include; depression, schizophrenia, bipolar disorder, anxiety disorder, attention-deficit hyperactivity disorder (ADHD). Drug addiction can also hurt all organs of the body and cause chronic organic health problems. Addiction leads to diseases that can kill the addicts, such as: heart diseases, stroke (brain injury from a blood clot) [27]. An addict person is more likely to have accidents while driving, addiction can make people angry and violent and can make people with depression feel worse, sometimes so bad that they want to kill themselves, suicide tendency and, drug overdoses can kill people [28-30]

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